

1/28

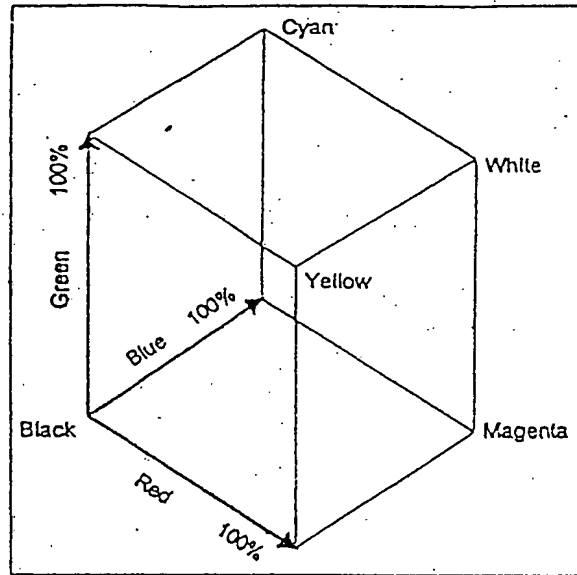


FIG. 1 PRIOR ART

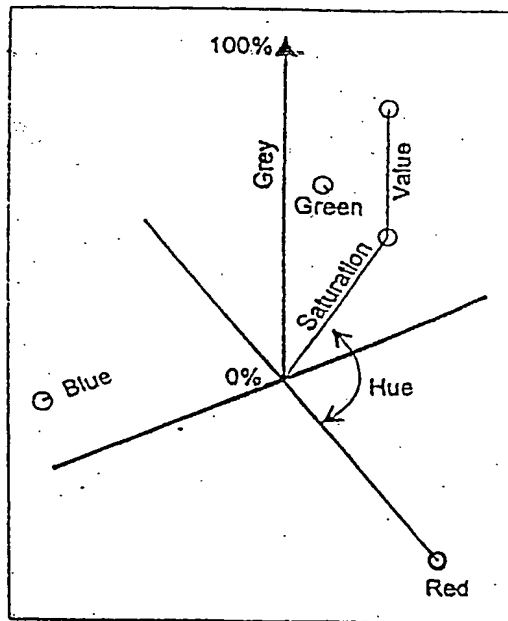


FIG. 2 PRIOR ART

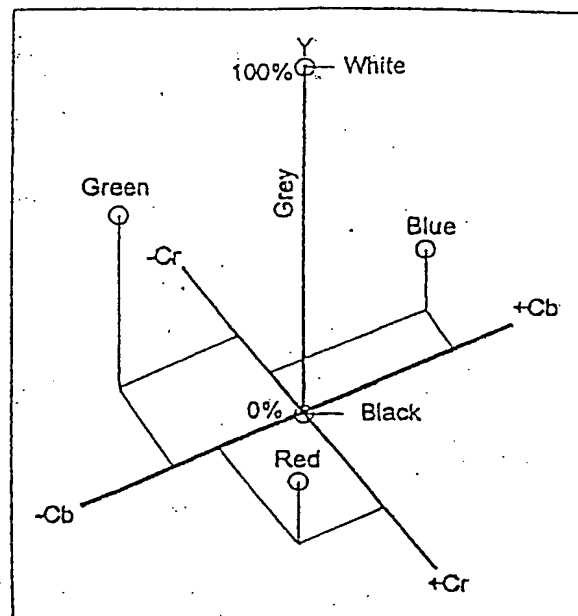


FIG. 3 PRIOR ART

2 / 28

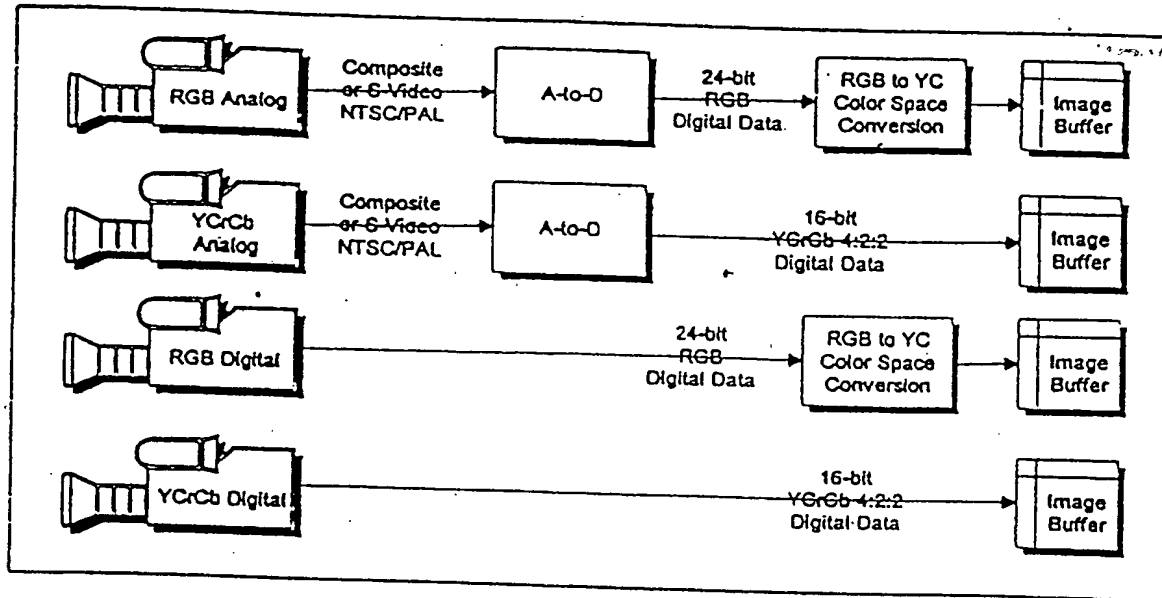


FIG. 4

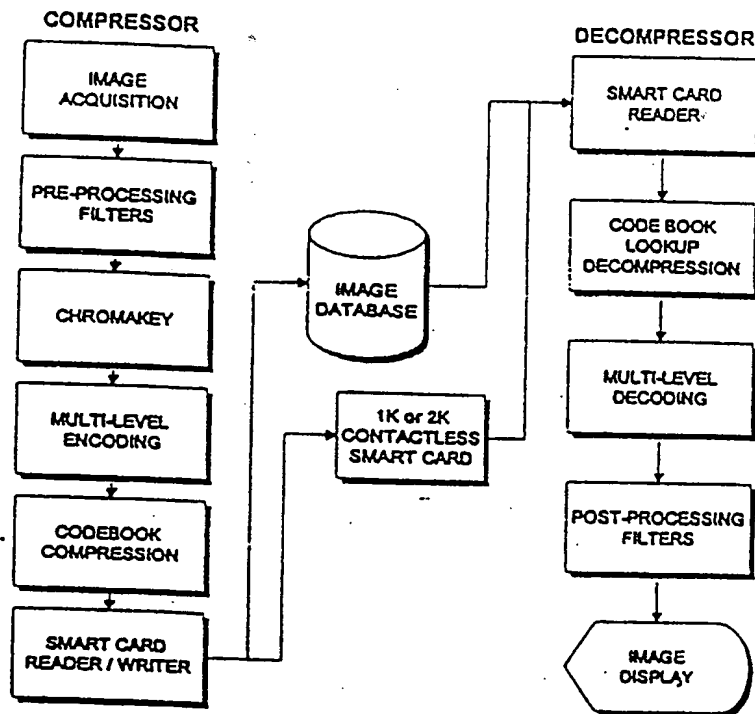


FIG. 5

3/28

If all pixels are within a specified threshold, the output is the average of the four pixels, two on each side of the target.

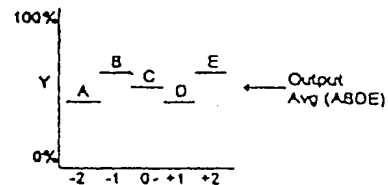
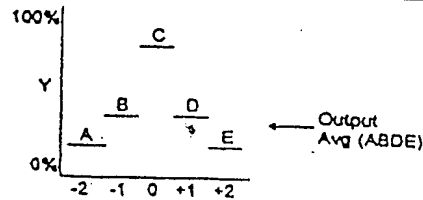
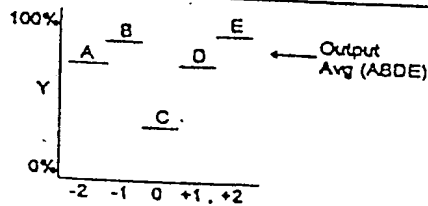


FIG. 6

If the two pixels on either side are within a specified threshold and both sides themselves are within the



threshold; the target pixel is considered to be impulse noise. The output is the average of the two pixels on each side of the target.

FIG. 7

4/28

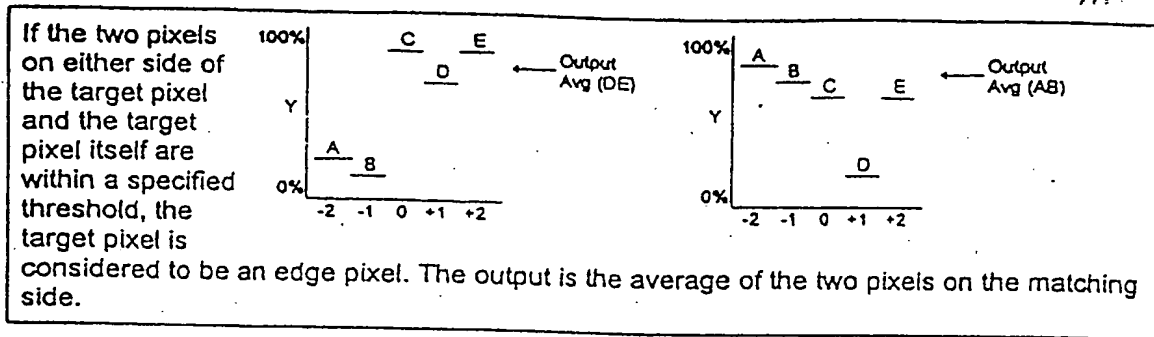


FIG. 8

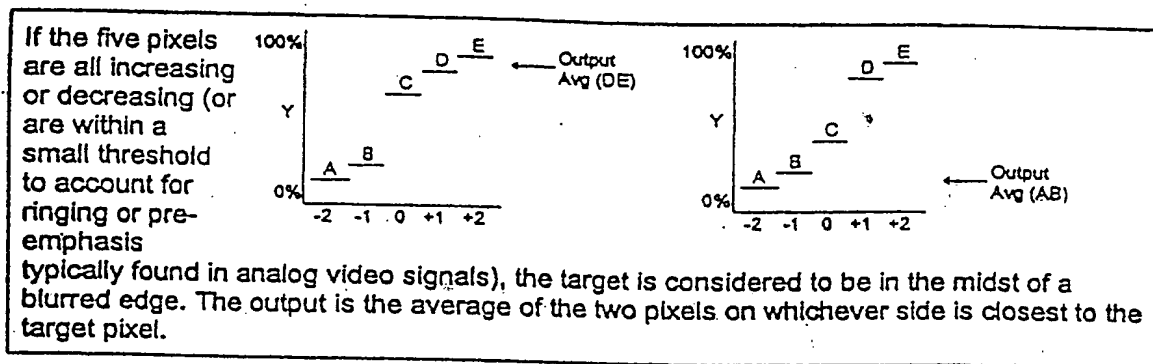


FIG. 9

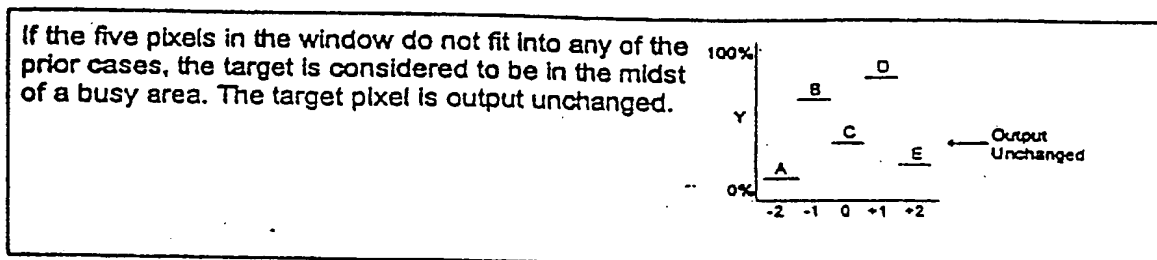


FIG. 10

5 / 8

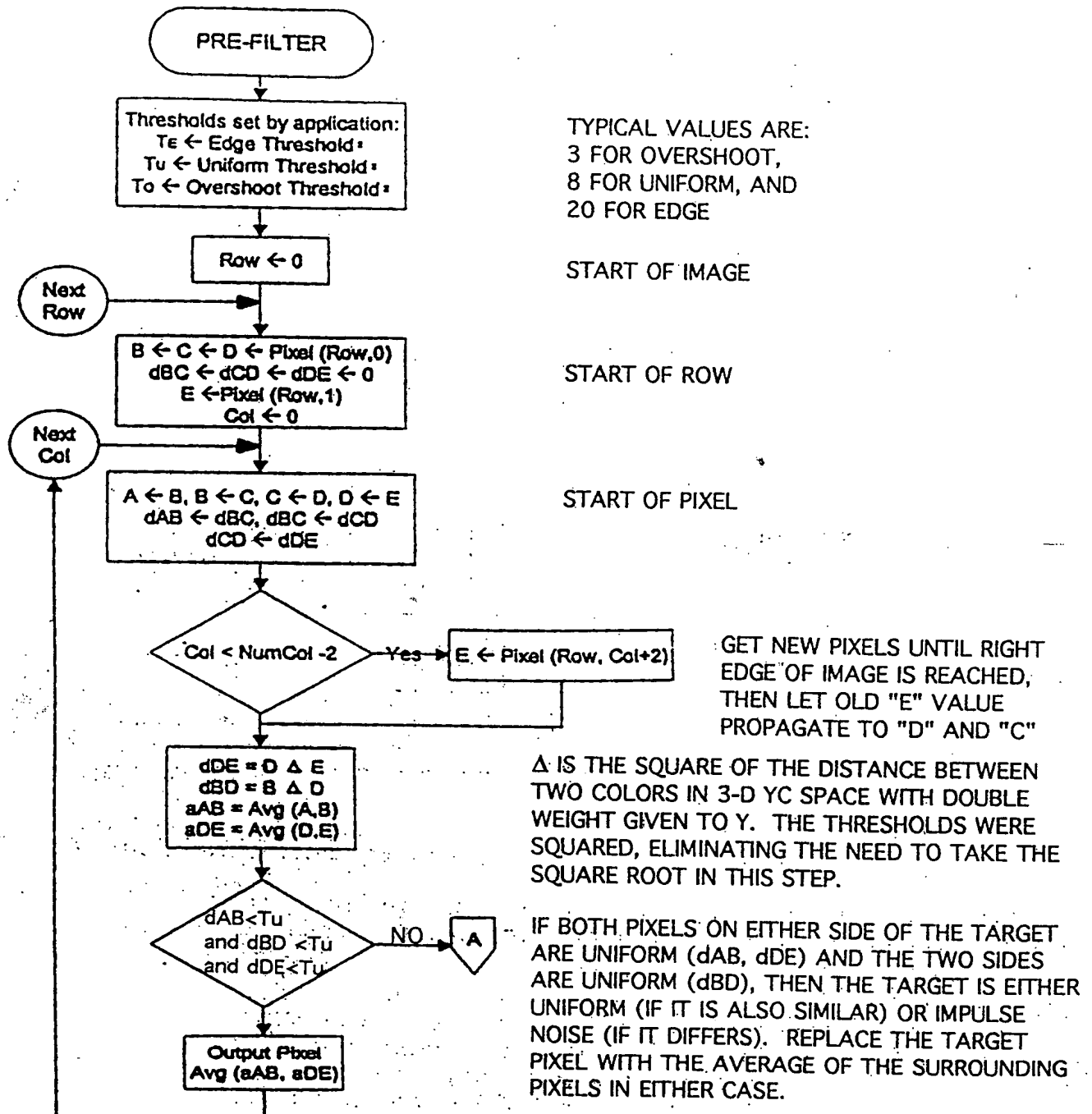


FIG. 11A

6/28

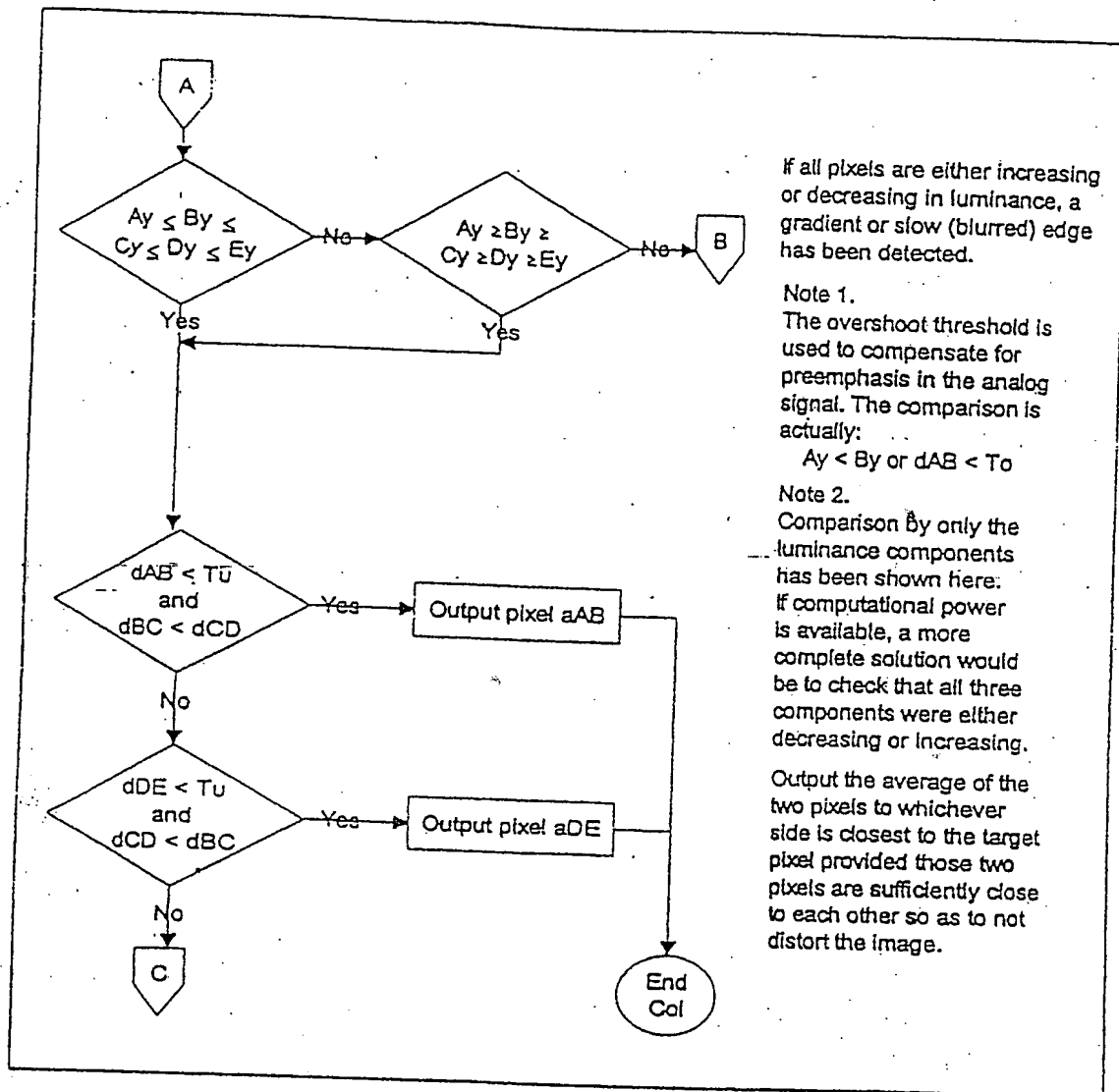


FIG. 11B

7/28

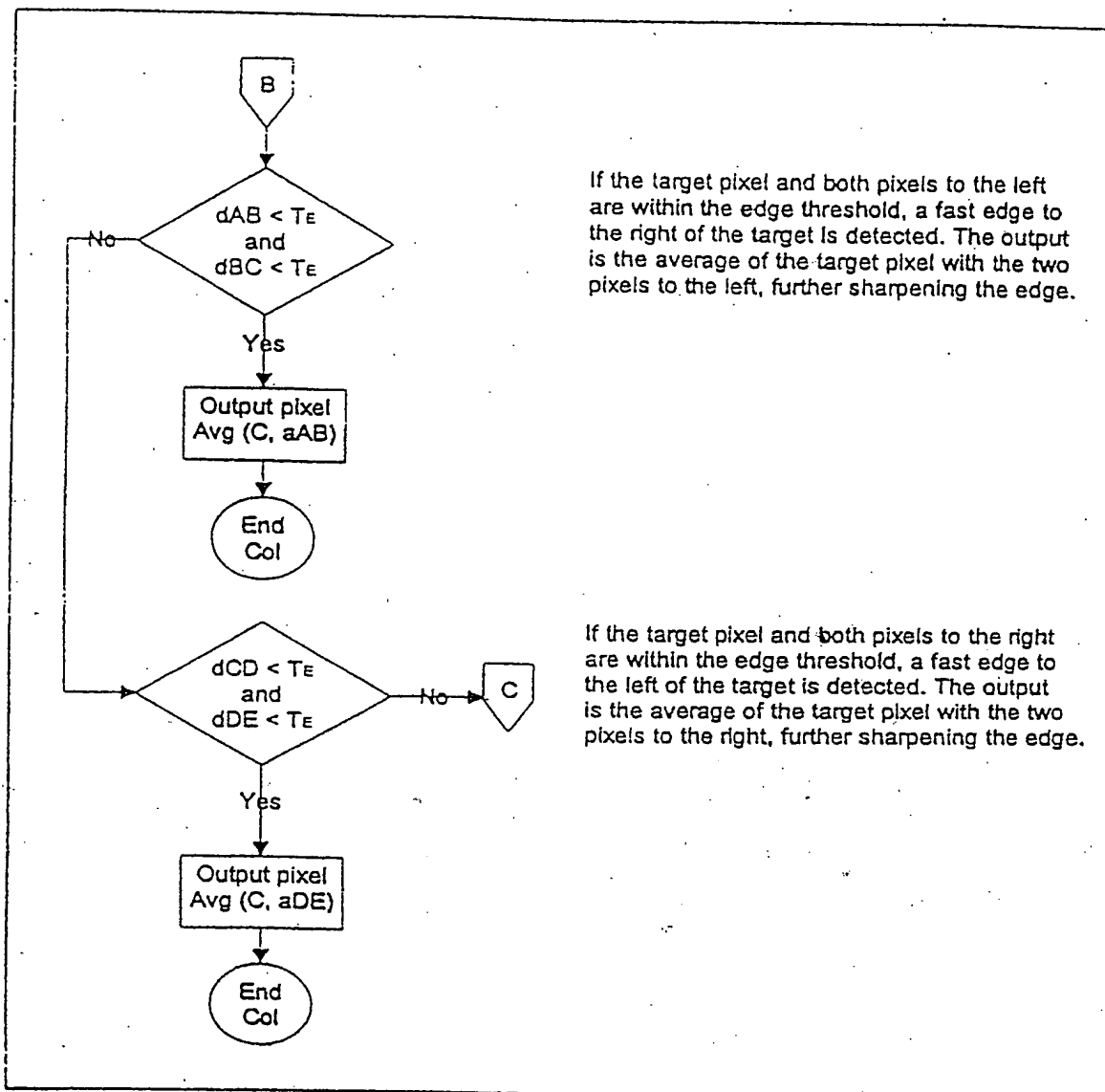
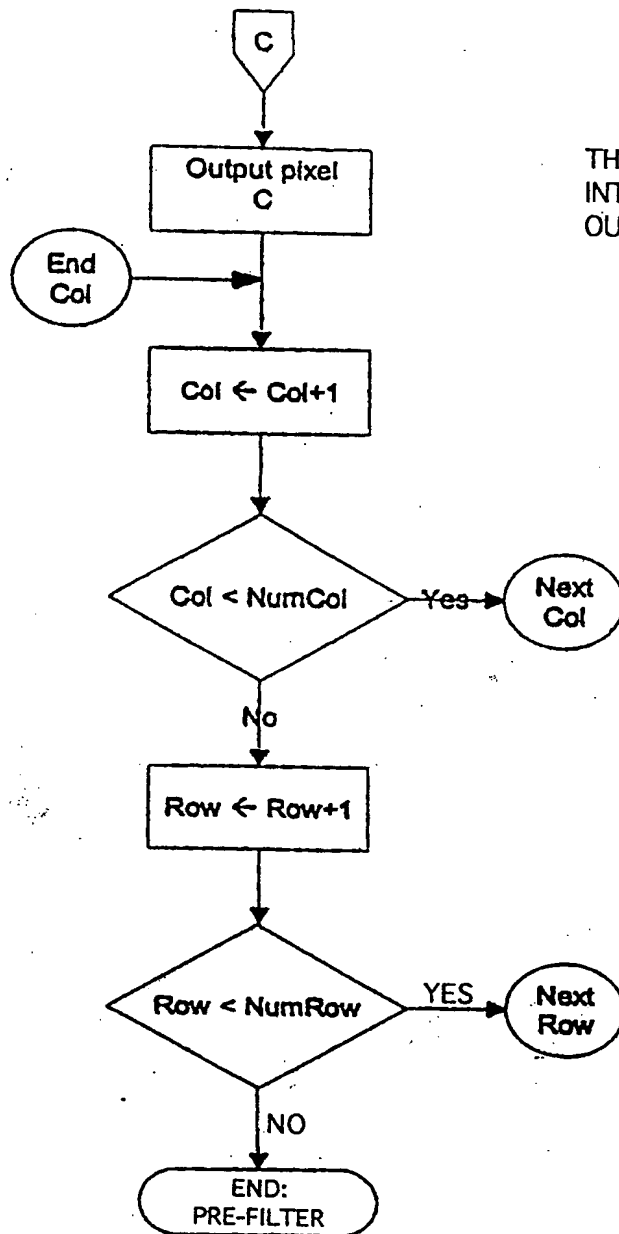


FIG. 11C

8/28



THE TARGET PIXEL HAS NOT FALLEN INTO ANY OF THE CASES, SO IT IS OUTPUT UNCHANGED.

FIG. 11D

9/28

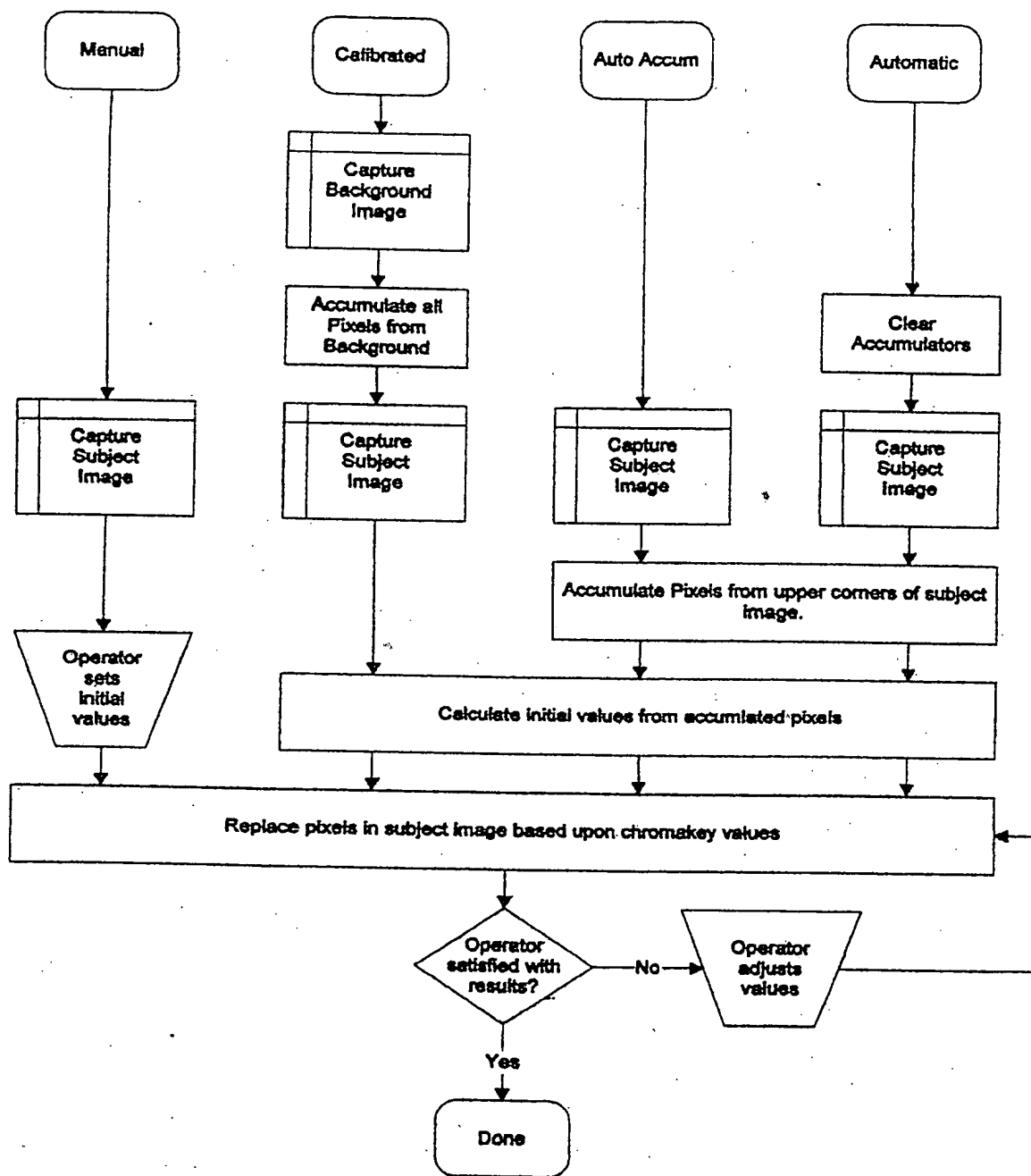


FIG. 11E

10/28

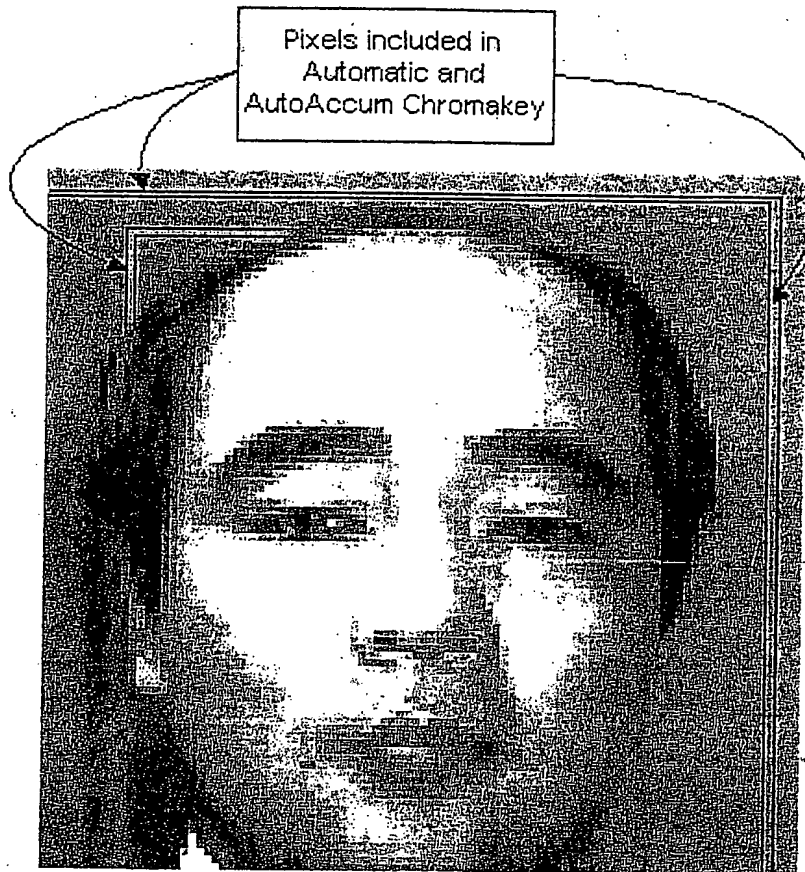
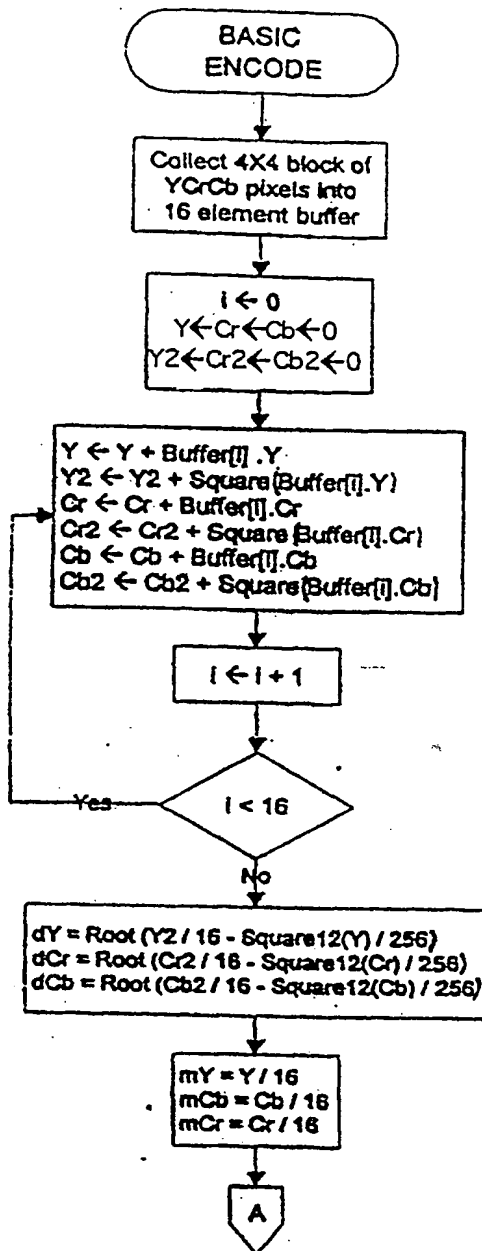


FIG. 11F

11/28



Buffer index will range from 0 to 15.
 Color components will be referred to as: ".Y", ".Cr", and ".Cb"

Step 1 - Collect first and second moments

Accumulate separate component values as squares for each pixel. Squares are calculated by table lookup rather than by multiplication.

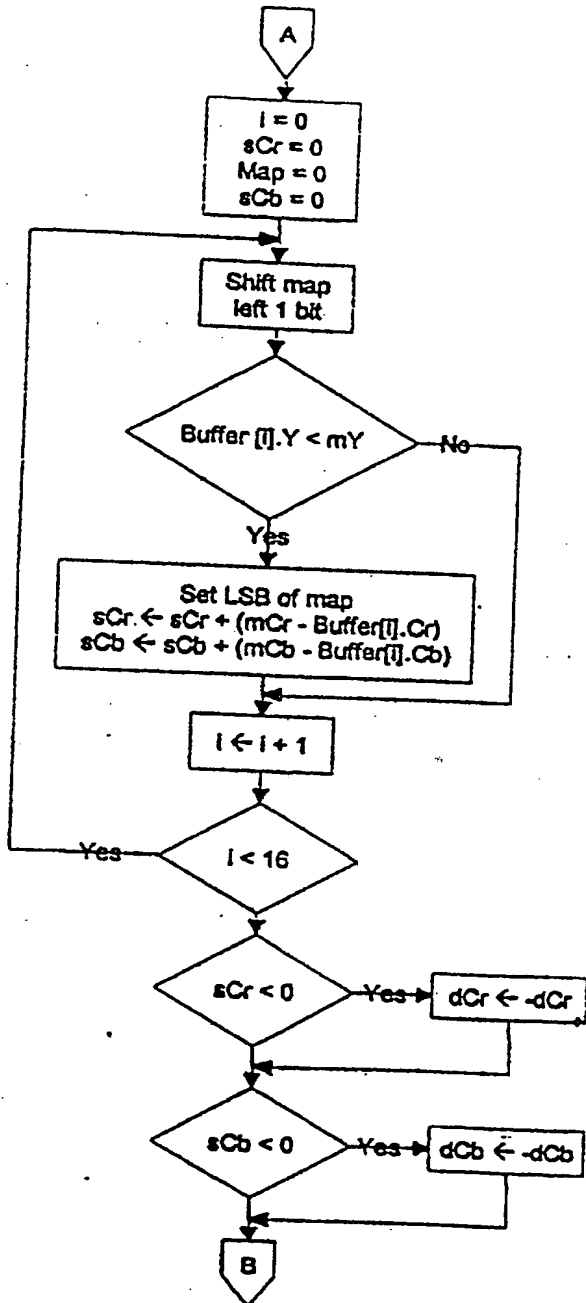
Step 2 - Calculate mean and standard deviation

The square12 function calculates the square of a 12-bit number using the same 8-bit table of squares above and little extra arithmetic. The root function finds roots by binary search of the 8-bit table of squares.

dY, dCr, and dCb are the standard deviations for each component and mY, mCr, and mCb are the arithmetic means.

FIG. 12A

12/28



Step 3 - Determine selector map

Use the mean luminance value for the selector.

The one bits in the map mark those pixels that are "darker" than the mean. Accumulate the signed differences from the mean in each chrominance channel.

If the Cr channel decreases when the luminance increases, invert dCr.

If the Cb channel decreases when the luminance increases, invert dCb.

FIG. 12B

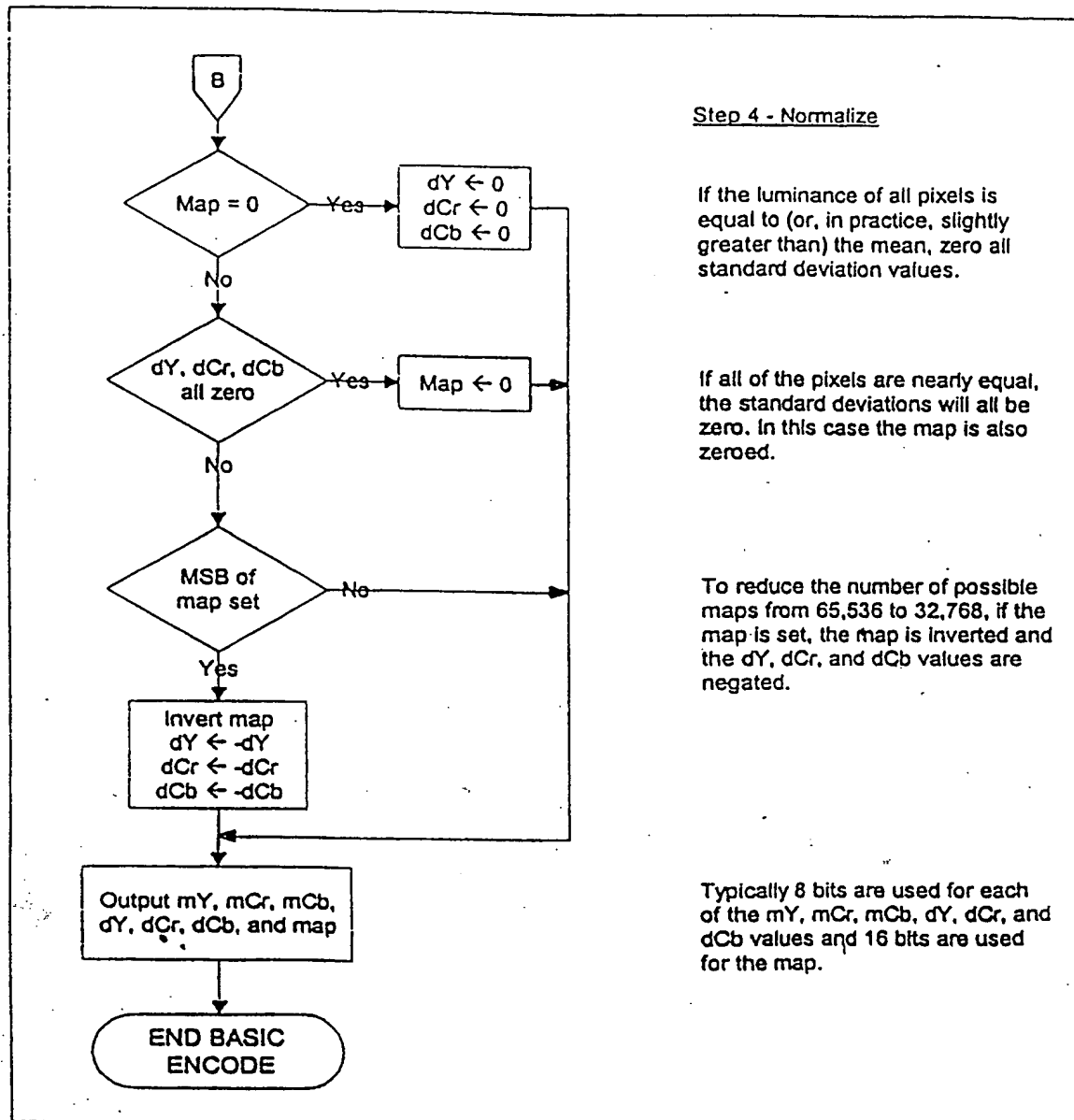


FIG. 12C

14/28

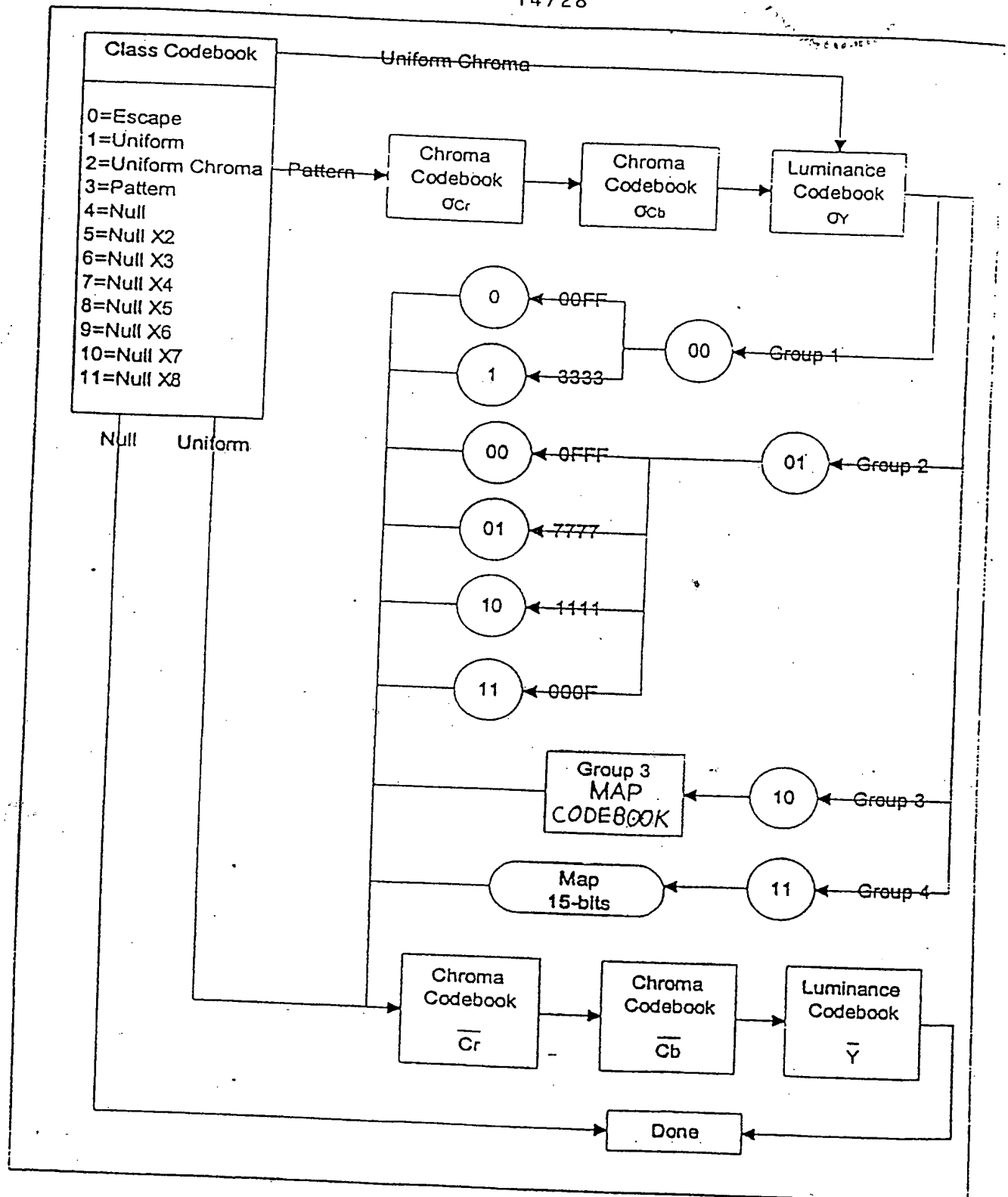


FIG. 13

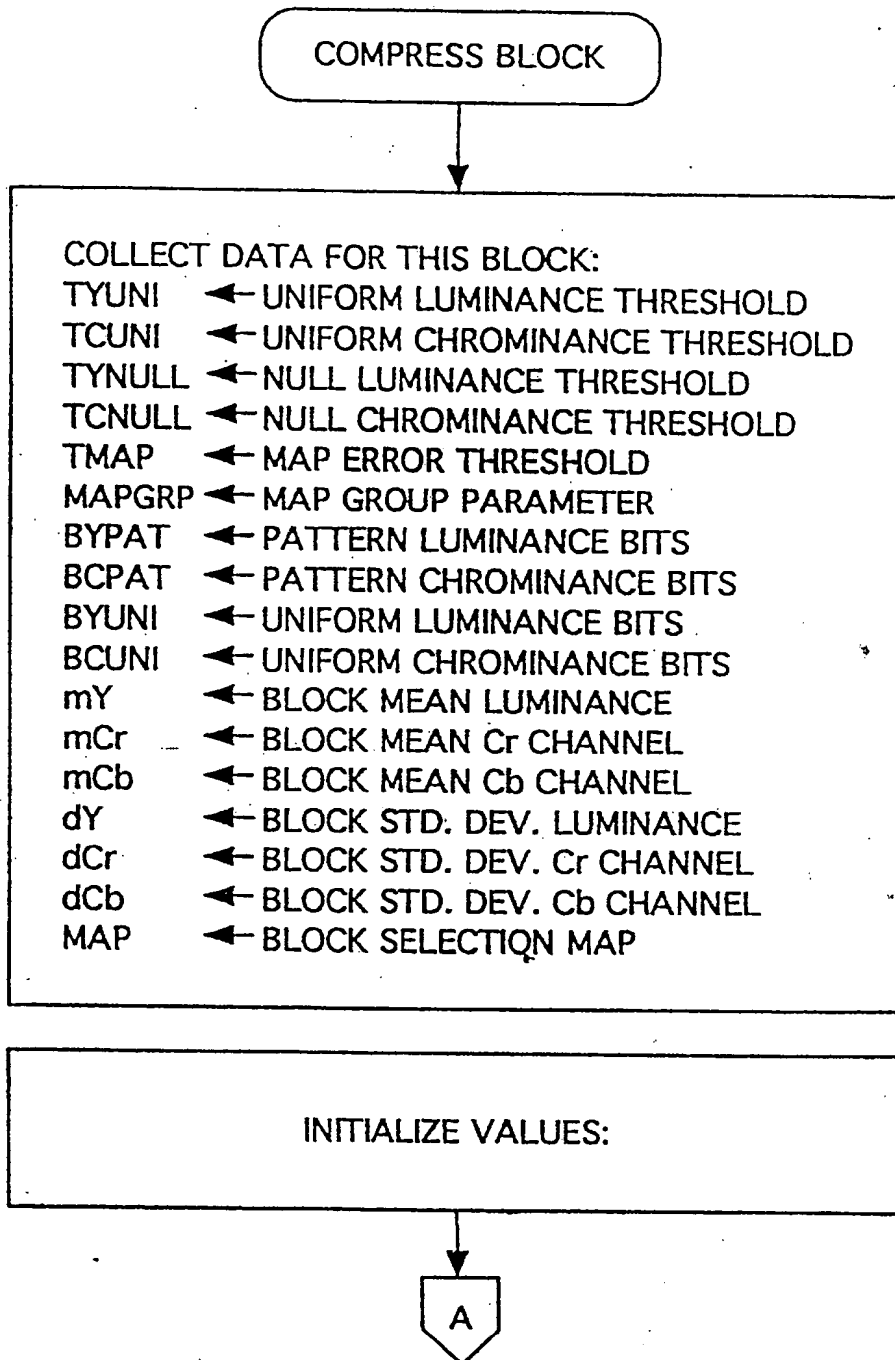


FIG. 14A

16/28

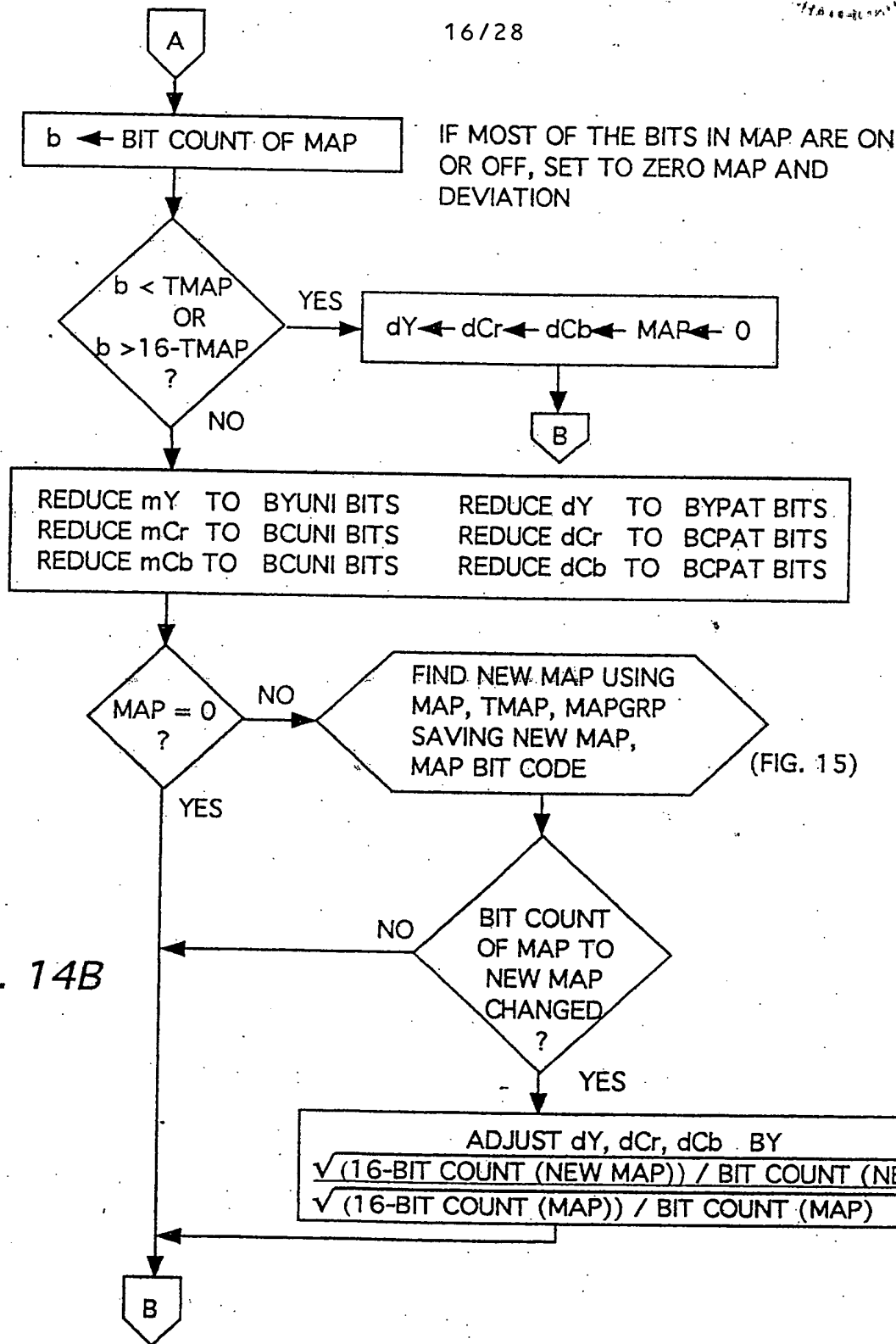


FIG. 14B

17/28

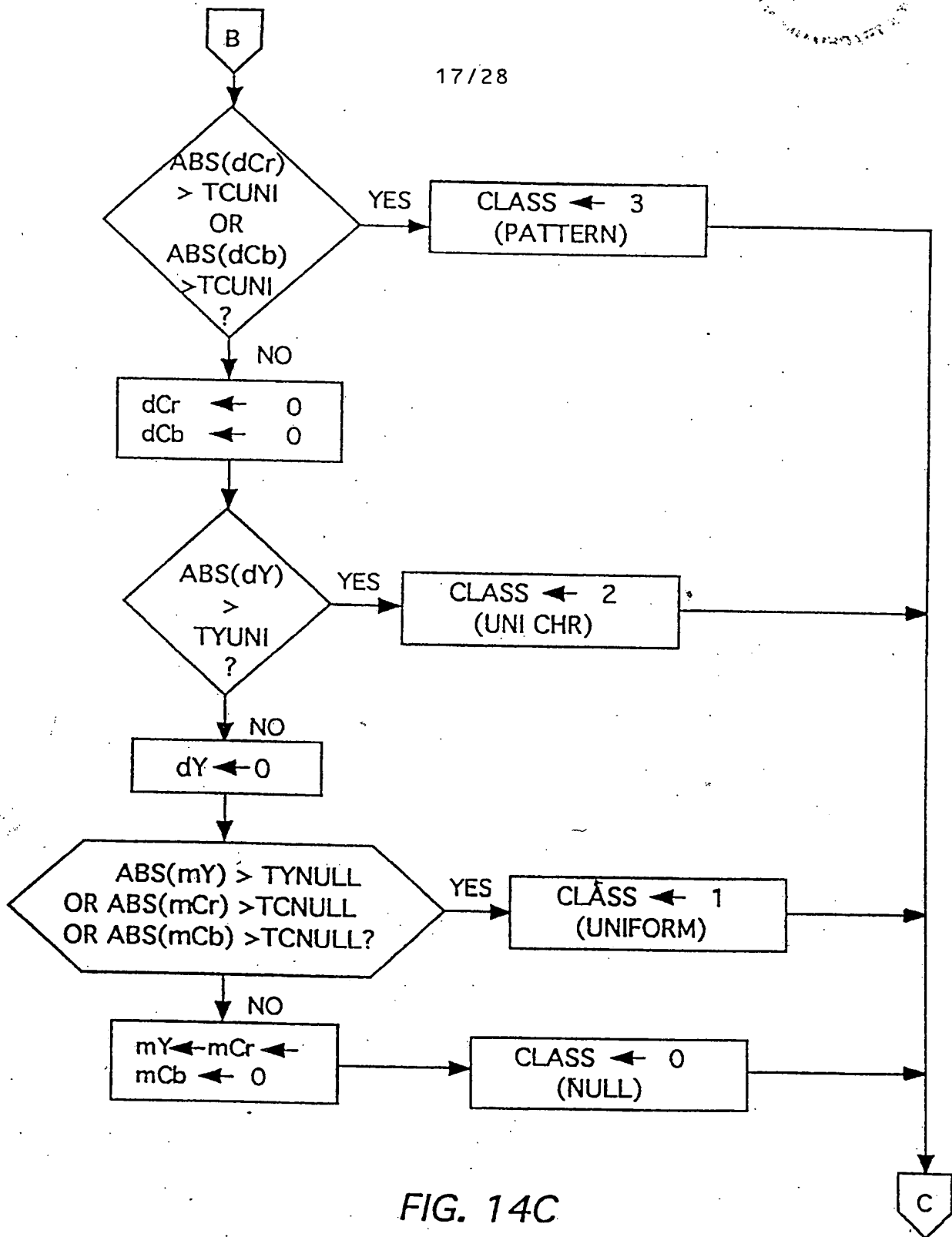


FIG. 14C

18/28

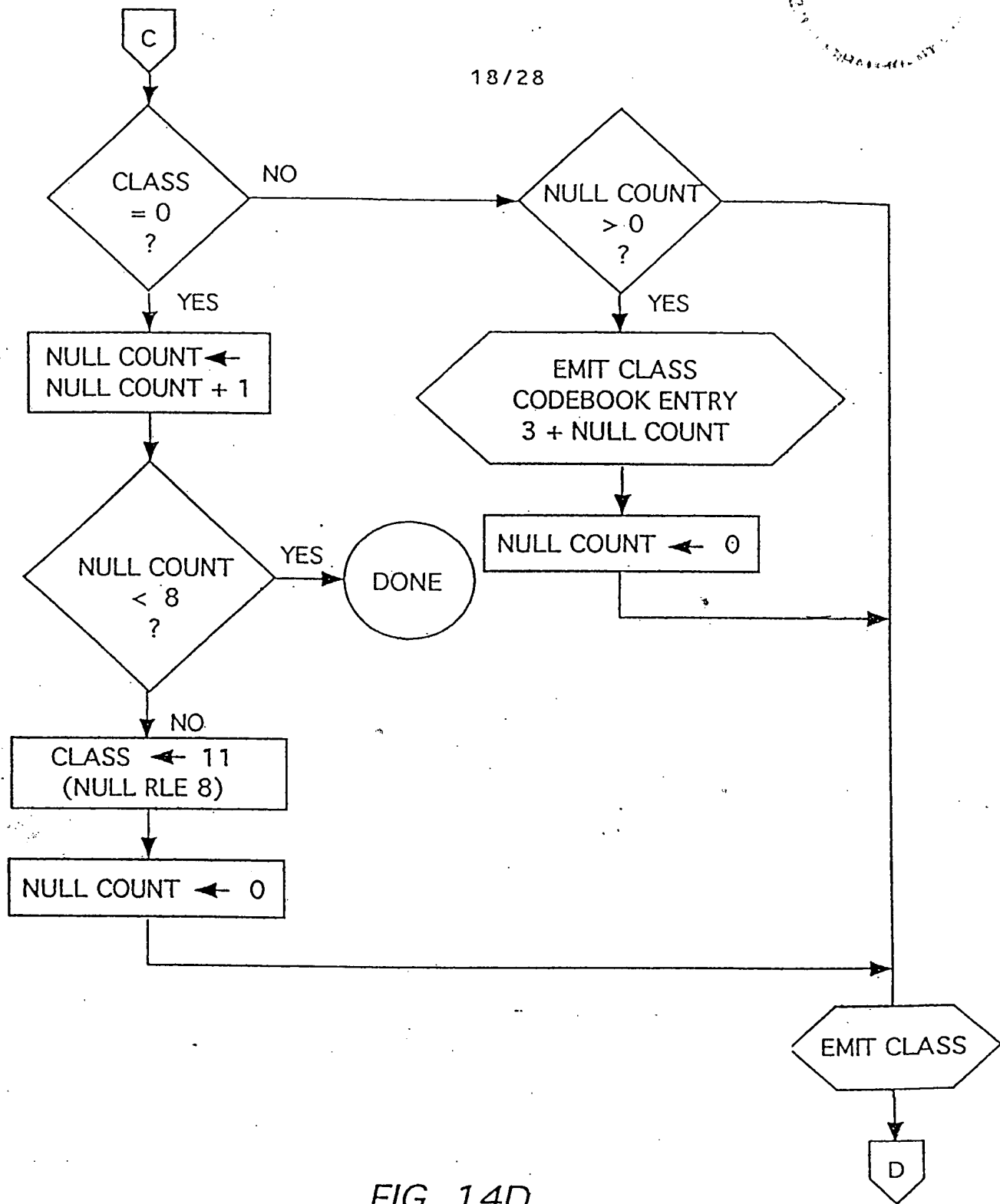


FIG. 14D

19/28

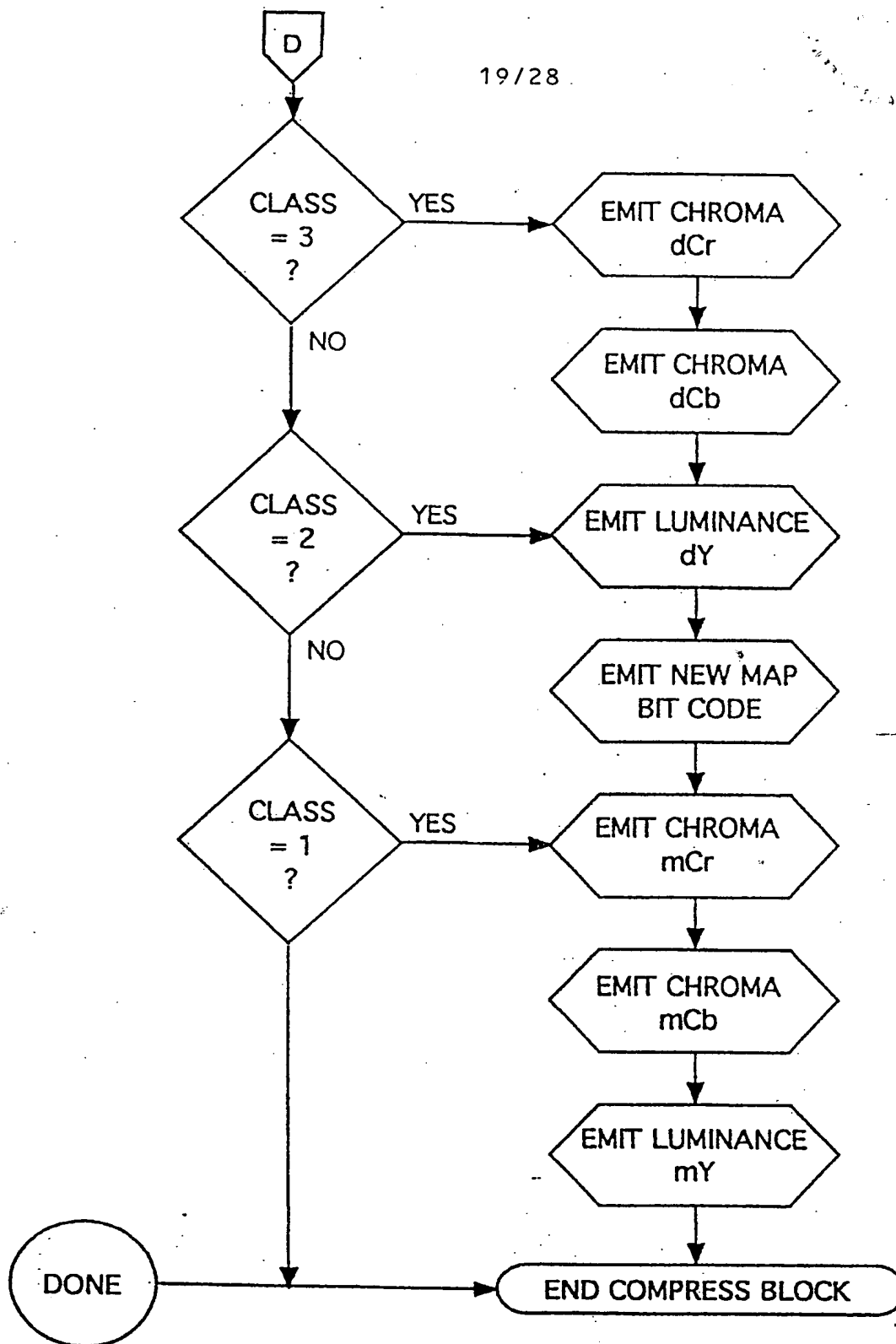


FIG. 14E

20/28

FIG. 15C

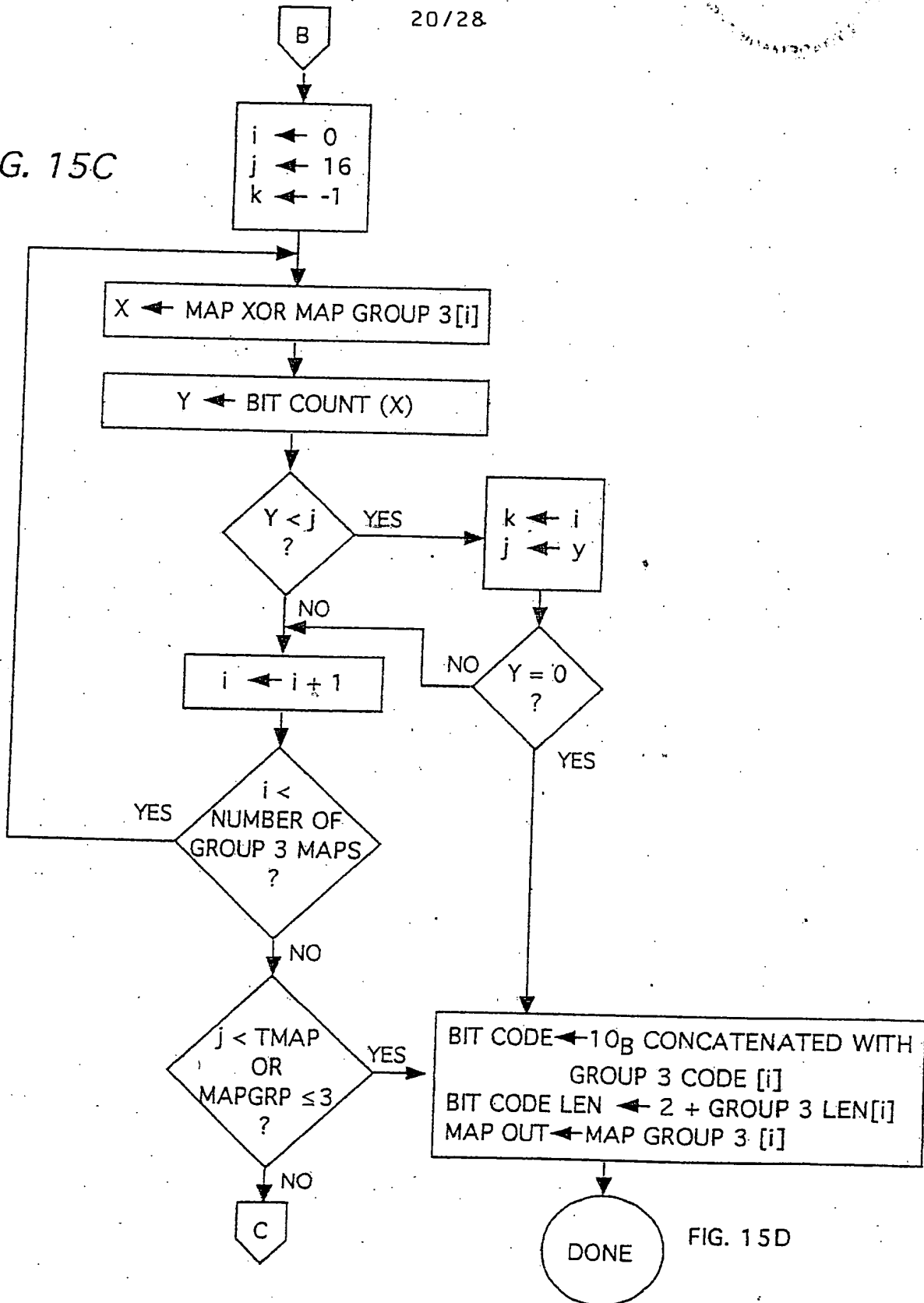


FIG. 15A

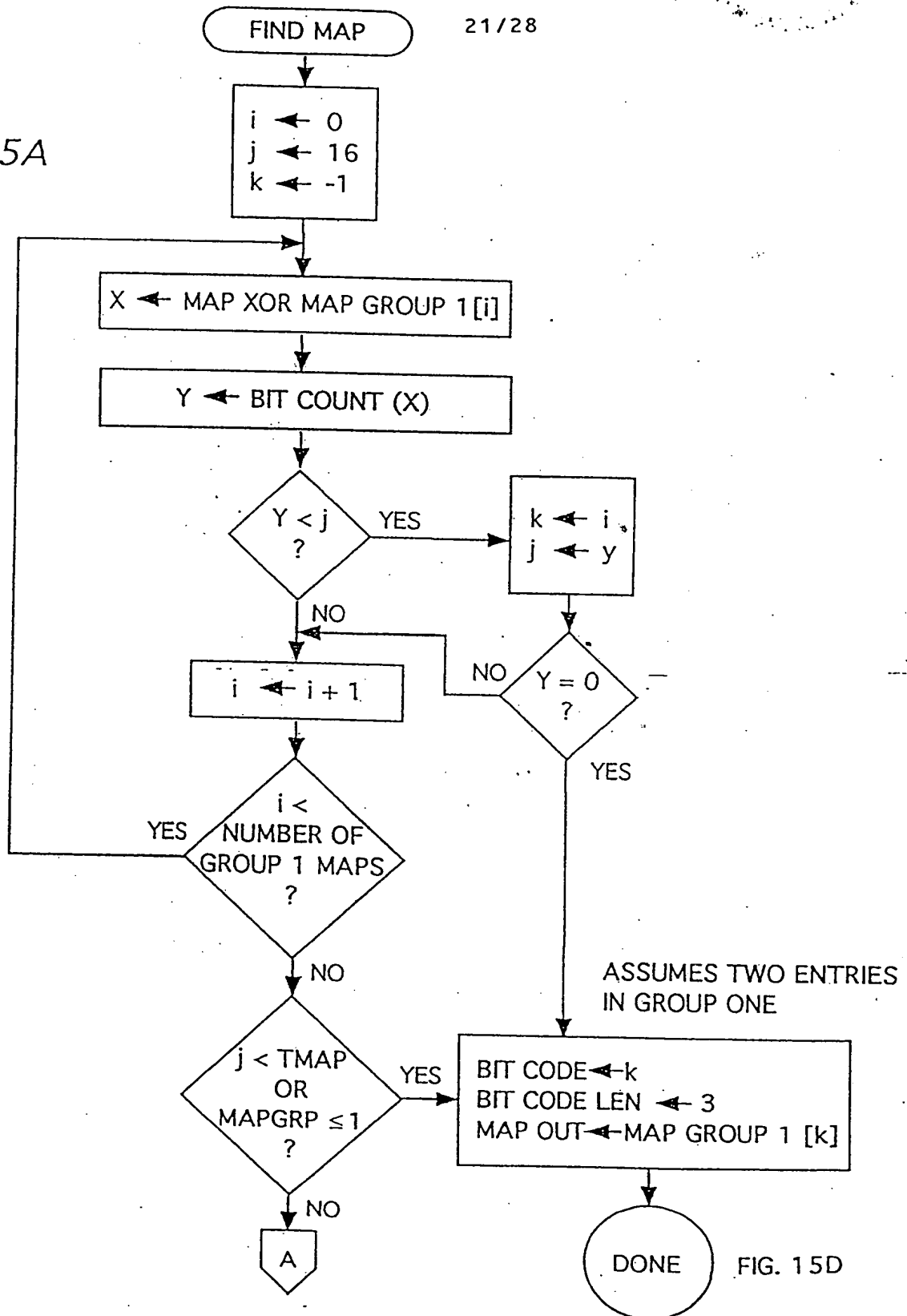
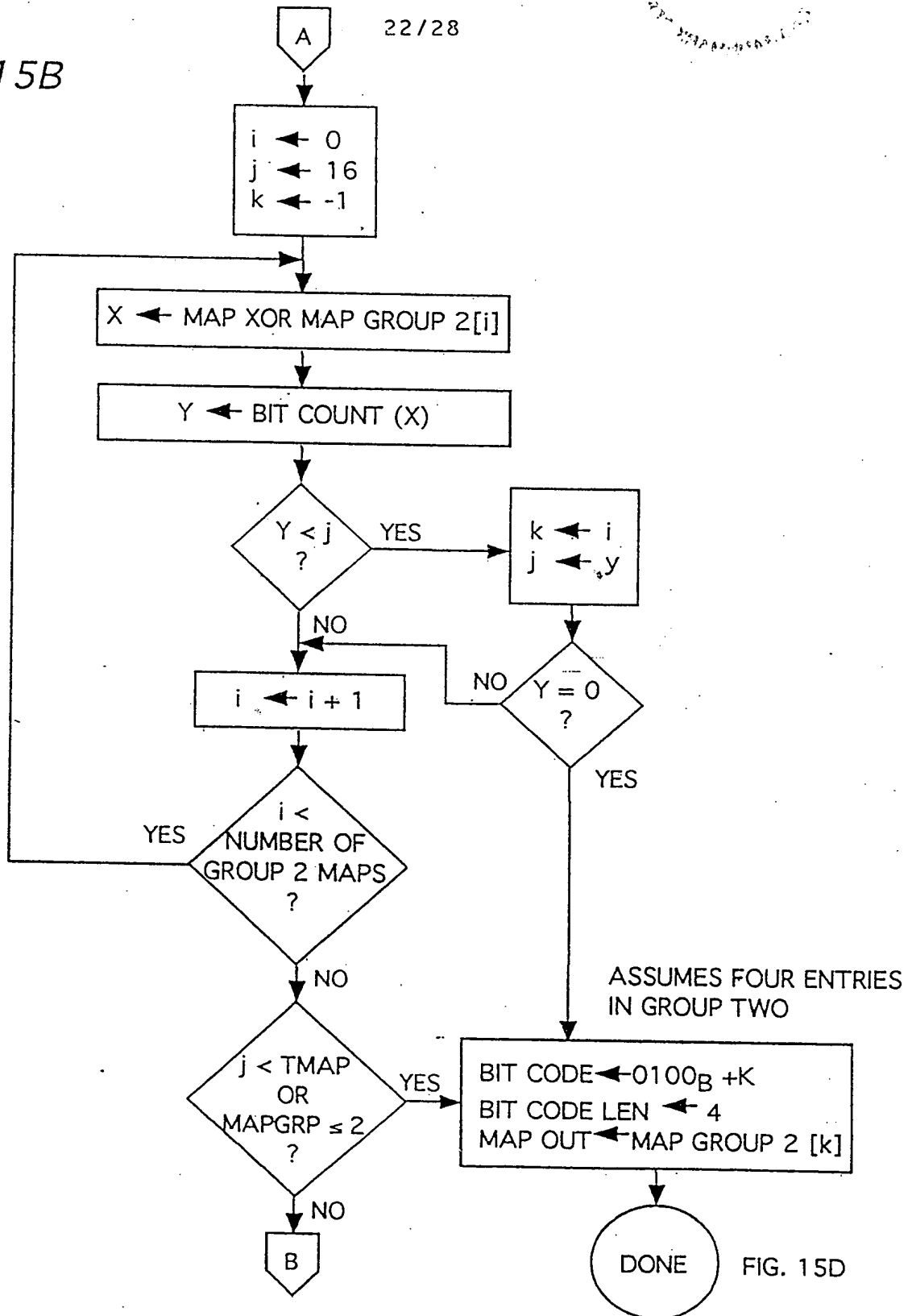


FIG. 15B



23/28

FIG. 16A

D	D	D	D	D	D
D	C	B	B	C	D
D	B	A	A	B	D
D	B	A	A	B	D
D	C	B	B	C	D
D	D	D	D	D	D

	CIRCLE	OVAL	BELL																																																																																																																																																																																																
NON-TRUNCATED	<table><tr><td>60</td><td>52</td><td>44</td><td>32</td><td>33</td><td>45</td><td>53</td><td>61</td></tr><tr><td>54</td><td>34</td><td>24</td><td>6</td><td>17</td><td>5</td><td>35</td><td>55</td></tr><tr><td>46</td><td>26</td><td>12</td><td>4</td><td>5</td><td>13</td><td>27</td><td>47</td></tr><tr><td>36</td><td>18</td><td>6</td><td>0</td><td>1</td><td>7</td><td>19</td><td>37</td></tr><tr><td>38</td><td>20</td><td>8</td><td>2</td><td>3</td><td>9</td><td>21</td><td>39</td></tr><tr><td>48</td><td>28</td><td>14</td><td>0</td><td>11</td><td>15</td><td>29</td><td>49</td></tr><tr><td>56</td><td>40</td><td>30</td><td>22</td><td>23</td><td>31</td><td>41</td><td>57</td></tr><tr><td>62</td><td>58</td><td>50</td><td>42</td><td>43</td><td>51</td><td>59</td><td>63</td></tr></table>	60	52	44	32	33	45	53	61	54	34	24	6	17	5	35	55	46	26	12	4	5	13	27	47	36	18	6	0	1	7	19	37	38	20	8	2	3	9	21	39	48	28	14	0	11	15	29	49	56	40	30	22	23	31	41	57	62	58	50	42	43	51	59	63	<table><tr><td>60</td><td>52</td><td>40</td><td>32</td><td>33</td><td>41</td><td>53</td><td>61</td></tr><tr><td>56</td><td>36</td><td>24</td><td>6</td><td>17</td><td>25</td><td>37</td><td>57</td></tr><tr><td>48</td><td>28</td><td>12</td><td>4</td><td>5</td><td>13</td><td>29</td><td>49</td></tr><tr><td>42</td><td>20</td><td>8</td><td>0</td><td>1</td><td>9</td><td>21</td><td>43</td></tr><tr><td>44</td><td>22</td><td>10</td><td>2</td><td>3</td><td>11</td><td>23</td><td>45</td></tr><tr><td>50</td><td>30</td><td>14</td><td>6</td><td>7</td><td>5</td><td>31</td><td>51</td></tr><tr><td>58</td><td>38</td><td>26</td><td>8</td><td>19</td><td>27</td><td>39</td><td>59</td></tr><tr><td>62</td><td>54</td><td>46</td><td>34</td><td>35</td><td>47</td><td>55</td><td>63</td></tr></table>	60	52	40	32	33	41	53	61	56	36	24	6	17	25	37	57	48	28	12	4	5	13	29	49	42	20	8	0	1	9	21	43	44	22	10	2	3	11	23	45	50	30	14	6	7	5	31	51	58	38	26	8	19	27	39	59	62	54	46	34	35	47	55	63	<table><tr><td>62</td><td>58</td><td>54</td><td>44</td><td>45</td><td>55</td><td>59</td><td>63</td></tr><tr><td>56</td><td>46</td><td>34</td><td>26</td><td>27</td><td>35</td><td>47</td><td>57</td></tr><tr><td>50</td><td>30</td><td>6</td><td>10</td><td>11</td><td>17</td><td>31</td><td>51</td></tr><tr><td>40</td><td>24</td><td>2</td><td>4</td><td>5</td><td>3</td><td>25</td><td>41</td></tr><tr><td>38</td><td>8</td><td>6</td><td>0</td><td>1</td><td>7</td><td>19</td><td>39</td></tr><tr><td>42</td><td>22</td><td>8</td><td>2</td><td>3</td><td>9</td><td>23</td><td>43</td></tr><tr><td>52</td><td>32</td><td>20</td><td>14</td><td>15</td><td>21</td><td>33</td><td>53</td></tr><tr><td>60</td><td>48</td><td>36</td><td>28</td><td>29</td><td>37</td><td>49</td><td>61</td></tr></table>	62	58	54	44	45	55	59	63	56	46	34	26	27	35	47	57	50	30	6	10	11	17	31	51	40	24	2	4	5	3	25	41	38	8	6	0	1	7	19	39	42	22	8	2	3	9	23	43	52	32	20	14	15	21	33	53	60	48	36	28	29	37	49	61
60	52	44	32	33	45	53	61																																																																																																																																																																																												
54	34	24	6	17	5	35	55																																																																																																																																																																																												
46	26	12	4	5	13	27	47																																																																																																																																																																																												
36	18	6	0	1	7	19	37																																																																																																																																																																																												
38	20	8	2	3	9	21	39																																																																																																																																																																																												
48	28	14	0	11	15	29	49																																																																																																																																																																																												
56	40	30	22	23	31	41	57																																																																																																																																																																																												
62	58	50	42	43	51	59	63																																																																																																																																																																																												
60	52	40	32	33	41	53	61																																																																																																																																																																																												
56	36	24	6	17	25	37	57																																																																																																																																																																																												
48	28	12	4	5	13	29	49																																																																																																																																																																																												
42	20	8	0	1	9	21	43																																																																																																																																																																																												
44	22	10	2	3	11	23	45																																																																																																																																																																																												
50	30	14	6	7	5	31	51																																																																																																																																																																																												
58	38	26	8	19	27	39	59																																																																																																																																																																																												
62	54	46	34	35	47	55	63																																																																																																																																																																																												
62	58	54	44	45	55	59	63																																																																																																																																																																																												
56	46	34	26	27	35	47	57																																																																																																																																																																																												
50	30	6	10	11	17	31	51																																																																																																																																																																																												
40	24	2	4	5	3	25	41																																																																																																																																																																																												
38	8	6	0	1	7	19	39																																																																																																																																																																																												
42	22	8	2	3	9	23	43																																																																																																																																																																																												
52	32	20	14	15	21	33	53																																																																																																																																																																																												
60	48	36	28	29	37	49	61																																																																																																																																																																																												
TRUNCATED	<table><tr><td>X</td><td>X</td><td>44</td><td>32</td><td>33</td><td>45</td><td>X</td><td>X</td></tr><tr><td>X</td><td>34</td><td>24</td><td>6</td><td>17</td><td>5</td><td>35</td><td>X</td></tr><tr><td>46</td><td>26</td><td>12</td><td>4</td><td>5</td><td>13</td><td>27</td><td>47</td></tr><tr><td>36</td><td>18</td><td>6</td><td>0</td><td>1</td><td>7</td><td>19</td><td>37</td></tr><tr><td>38</td><td>20</td><td>8</td><td>2</td><td>3</td><td>9</td><td>21</td><td>39</td></tr><tr><td>48</td><td>28</td><td>14</td><td>0</td><td>11</td><td>15</td><td>29</td><td>49</td></tr><tr><td>X</td><td>40</td><td>30</td><td>22</td><td>23</td><td>31</td><td>41</td><td>X</td></tr><tr><td>X</td><td>X</td><td>50</td><td>42</td><td>43</td><td>51</td><td>X</td><td>X</td></tr></table>	X	X	44	32	33	45	X	X	X	34	24	6	17	5	35	X	46	26	12	4	5	13	27	47	36	18	6	0	1	7	19	37	38	20	8	2	3	9	21	39	48	28	14	0	11	15	29	49	X	40	30	22	23	31	41	X	X	X	50	42	43	51	X	X	<table><tr><td>X</td><td>X</td><td>40</td><td>32</td><td>33</td><td>41</td><td>X</td><td>X</td></tr><tr><td>X</td><td>36</td><td>24</td><td>6</td><td>17</td><td>25</td><td>37</td><td>X</td></tr><tr><td>48</td><td>28</td><td>12</td><td>4</td><td>5</td><td>13</td><td>29</td><td>49</td></tr><tr><td>42</td><td>20</td><td>8</td><td>0</td><td>1</td><td>9</td><td>21</td><td>43</td></tr><tr><td>44</td><td>22</td><td>10</td><td>2</td><td>3</td><td>11</td><td>23</td><td>45</td></tr><tr><td>50</td><td>30</td><td>14</td><td>6</td><td>7</td><td>5</td><td>31</td><td>51</td></tr><tr><td>X</td><td>38</td><td>26</td><td>8</td><td>19</td><td>27</td><td>39</td><td>X</td></tr><tr><td>X</td><td>X</td><td>46</td><td>34</td><td>35</td><td>47</td><td>X</td><td>X</td></tr></table>	X	X	40	32	33	41	X	X	X	36	24	6	17	25	37	X	48	28	12	4	5	13	29	49	42	20	8	0	1	9	21	43	44	22	10	2	3	11	23	45	50	30	14	6	7	5	31	51	X	38	26	8	19	27	39	X	X	X	46	34	35	47	X	X	<table><tr><td>X</td><td>X</td><td>50</td><td>44</td><td>45</td><td>51</td><td>X</td><td>X</td></tr><tr><td>X</td><td>46</td><td>34</td><td>26</td><td>27</td><td>35</td><td>47</td><td>X</td></tr><tr><td>48</td><td>30</td><td>6</td><td>10</td><td>11</td><td>17</td><td>31</td><td>49</td></tr><tr><td>40</td><td>24</td><td>2</td><td>4</td><td>5</td><td>3</td><td>25</td><td>41</td></tr><tr><td>38</td><td>8</td><td>6</td><td>0</td><td>1</td><td>7</td><td>19</td><td>39</td></tr><tr><td>42</td><td>22</td><td>8</td><td>2</td><td>3</td><td>9</td><td>23</td><td>43</td></tr><tr><td>X</td><td>32</td><td>20</td><td>14</td><td>15</td><td>21</td><td>33</td><td>X</td></tr><tr><td>X</td><td>X</td><td>36</td><td>28</td><td>29</td><td>37</td><td>X</td><td>X</td></tr></table>	X	X	50	44	45	51	X	X	X	46	34	26	27	35	47	X	48	30	6	10	11	17	31	49	40	24	2	4	5	3	25	41	38	8	6	0	1	7	19	39	42	22	8	2	3	9	23	43	X	32	20	14	15	21	33	X	X	X	36	28	29	37	X	X
X	X	44	32	33	45	X	X																																																																																																																																																																																												
X	34	24	6	17	5	35	X																																																																																																																																																																																												
46	26	12	4	5	13	27	47																																																																																																																																																																																												
36	18	6	0	1	7	19	37																																																																																																																																																																																												
38	20	8	2	3	9	21	39																																																																																																																																																																																												
48	28	14	0	11	15	29	49																																																																																																																																																																																												
X	40	30	22	23	31	41	X																																																																																																																																																																																												
X	X	50	42	43	51	X	X																																																																																																																																																																																												
X	X	40	32	33	41	X	X																																																																																																																																																																																												
X	36	24	6	17	25	37	X																																																																																																																																																																																												
48	28	12	4	5	13	29	49																																																																																																																																																																																												
42	20	8	0	1	9	21	43																																																																																																																																																																																												
44	22	10	2	3	11	23	45																																																																																																																																																																																												
50	30	14	6	7	5	31	51																																																																																																																																																																																												
X	38	26	8	19	27	39	X																																																																																																																																																																																												
X	X	46	34	35	47	X	X																																																																																																																																																																																												
X	X	50	44	45	51	X	X																																																																																																																																																																																												
X	46	34	26	27	35	47	X																																																																																																																																																																																												
48	30	6	10	11	17	31	49																																																																																																																																																																																												
40	24	2	4	5	3	25	41																																																																																																																																																																																												
38	8	6	0	1	7	19	39																																																																																																																																																																																												
42	22	8	2	3	9	23	43																																																																																																																																																																																												
X	32	20	14	15	21	33	X																																																																																																																																																																																												
X	X	36	28	29	37	X	X																																																																																																																																																																																												
CONTROL POINTS	<p>1/2</p> <p>1/2</p> <p>①</p>	<p>1/2</p> <p>1/4</p> <p>1/4</p> <p>1/4</p> <p>①</p> <p>②</p> <p>③</p>	<p>1/2</p> <p>1/3</p> <p>1/3</p> <p>1/3</p> <p>①</p> <p>②</p> <p>③</p>																																																																																																																																																																																																

FIG. 16B

24/28

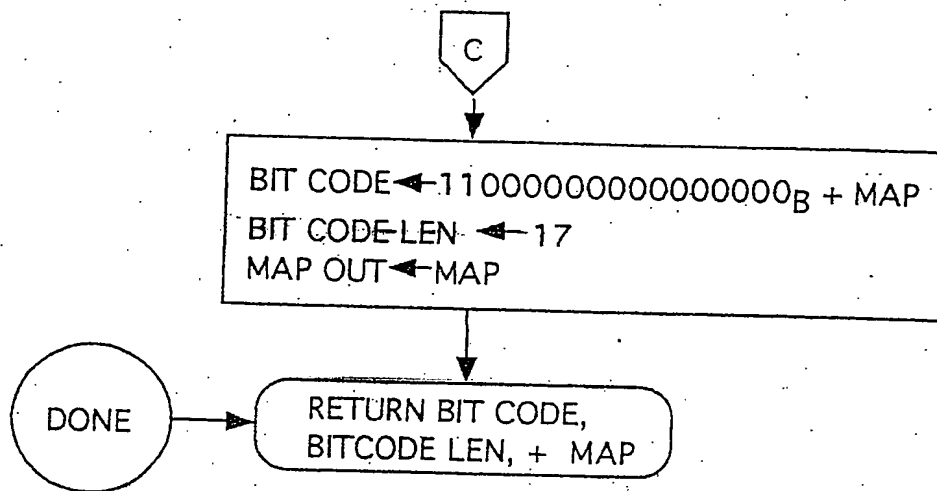


FIG. 15D

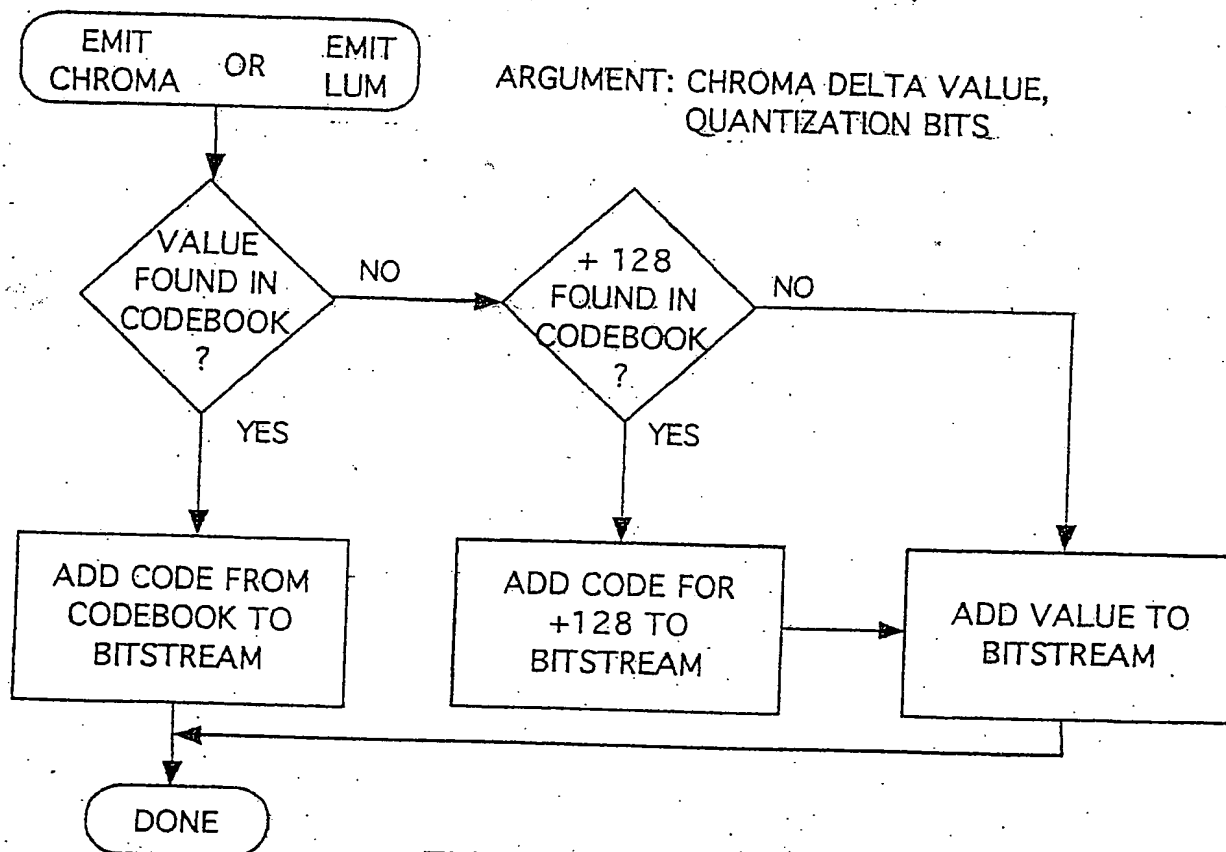


FIG. 17

25/28

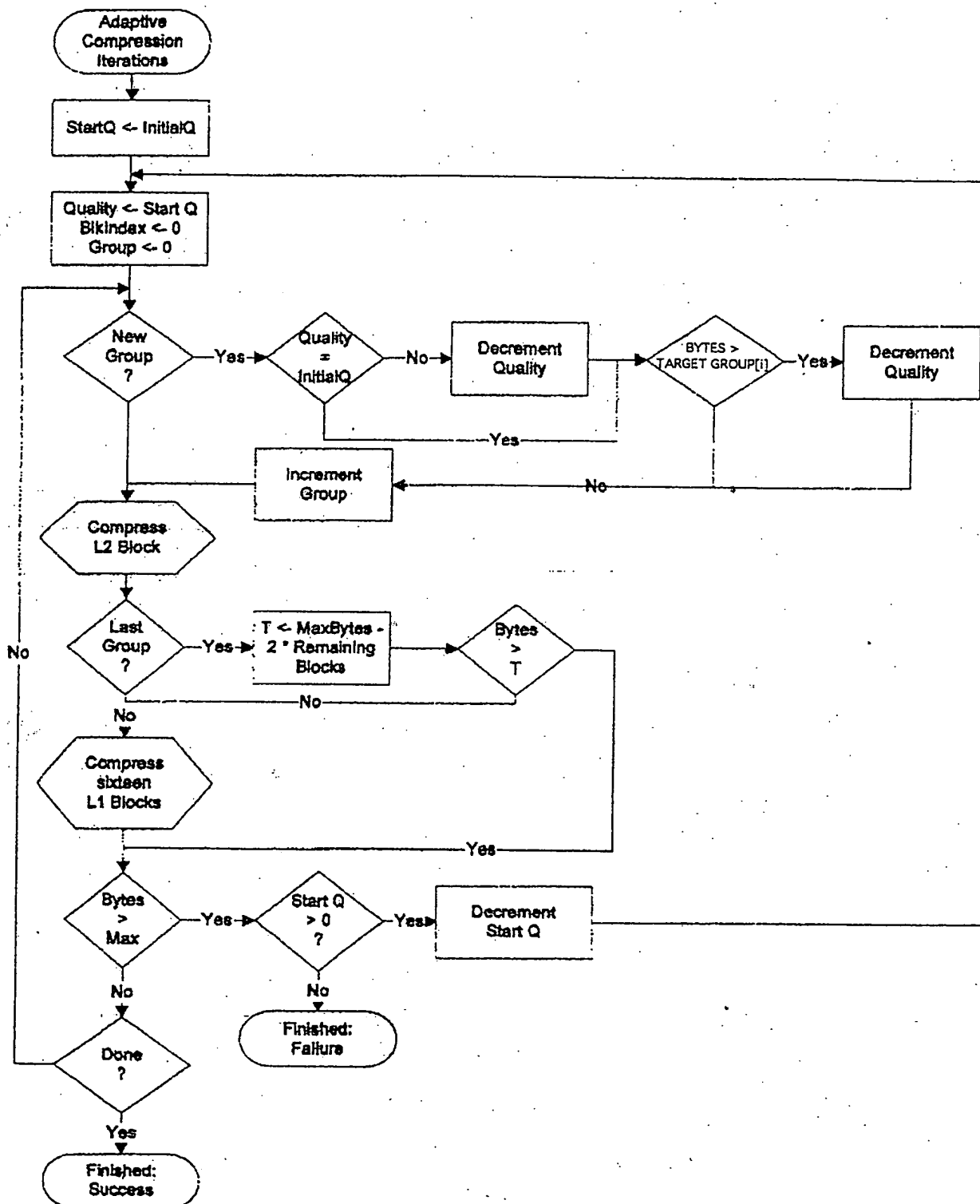


FIG. 18

26/28

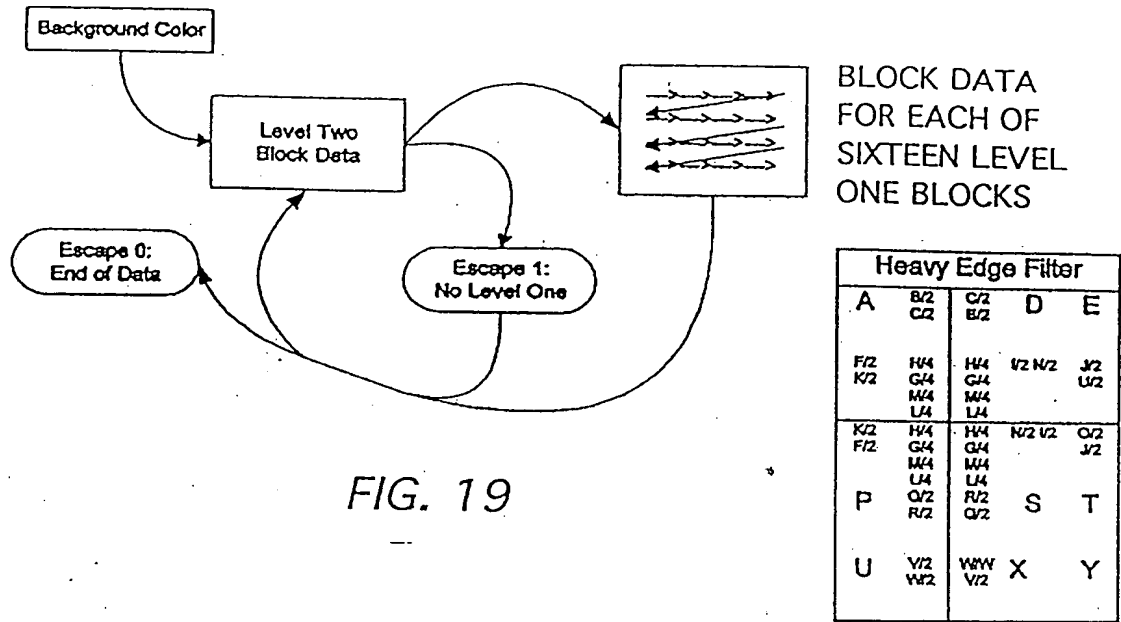


FIG. 19

Input				
A	B	C	D	E
F	G	H	I	J
K	L	M	N	O
P	Q	R	S	T
U	V	W	X	Y

Light Edge Filter				
A	3B/4 C/4	3C/4 B/4	D	E
3F/4 K/4	9G/16 3H/16 3L/16 3M/16	9H/16 3G/16 3M/16 L/16	3I/4 N/4 O/4	
3K/4 G/4	9L/16 3H/16 3G/16 H/16	9H/16 3L/16 3H/16 G/16	3N/4 I/4 J/4	
P	3Q/4 R/4	3R/4 Q/4	S	T
U	3V/4 W/4	3W/4 V/4	X	Y

Medium Edge Filter				
A	2B/3 C/3	2C/3 B/3	D	E
2F/3 K/3	4G/9 2H/9 2L/9 M/9	4H/9 2G/9 2M/9 L/9	2I/3 N/3 O/3	
2K/3 F/3	4L/9 2H/9 2G/9 H/9	4H/9 2L/9 2H/9 G/9	2N/3 I/3 J/3	
P	2Q/3 R/3	2R/3 Q/3	S	T
U	2V/3 W/3	2W/3 V/3	X	Y

FIG. 20D

FIG. 20A

FIG. 20B

FIG. 20C

27/28

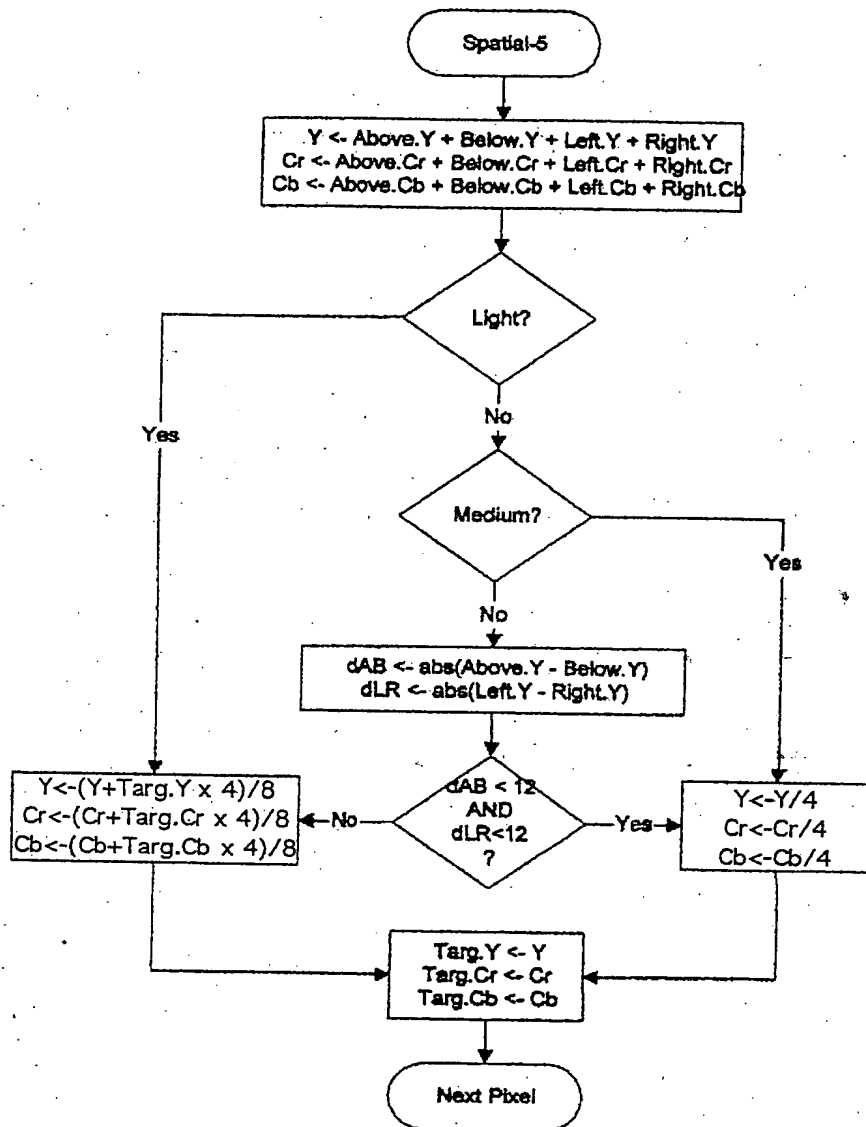


FIG. 21

28/28

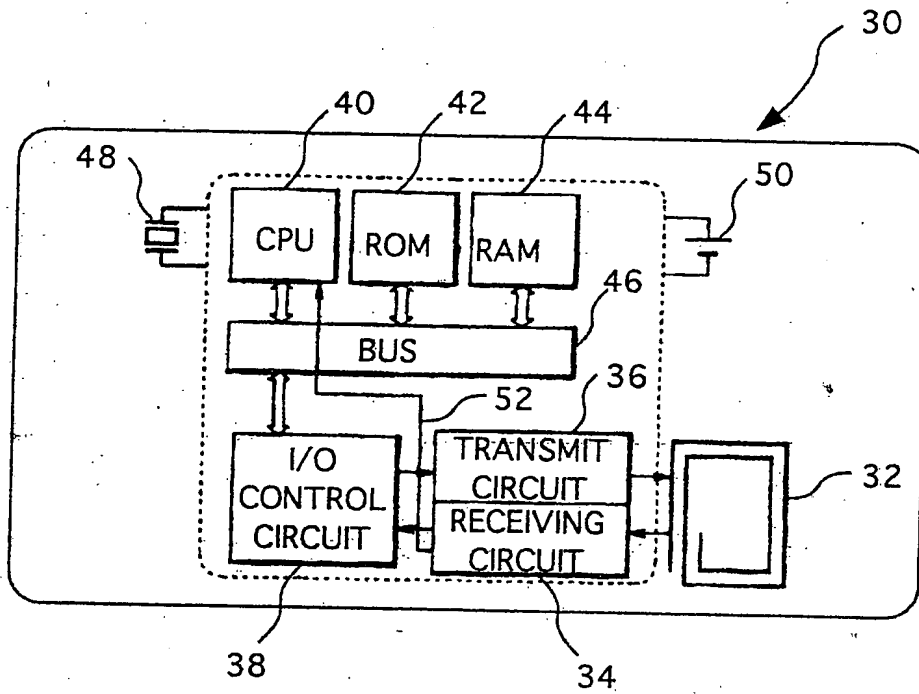


FIG. 22